

Name: _____

Biology 3550
Physical Principles in Biology
Fall Semester 2017

Quiz 1
1 September 2017

Please write your name on each page.

Be sure to show your work and include correct units in all of your answers!

Be sure to report your answers with the correct number of significant figures, that is no more than for the least precise input value.

25 points total.

1. A typical yeast cell is roughly spherical and has a radius of about $5\ \mu\text{m}$. The nucleus of a yeast cell is also roughly spherical, with a radius of about $2\ \mu\text{m}$.
 - (a) (5 pts) What is the volume of a typical yeast cell? Express your answer in both μm^3 and μL .

Name: _____

(b) (5 pts) What fraction of the total cell volume does the nucleus occupy? (There's a hard way and an easy way to do this!)

(c) (5 pts) Assume that the average concentration of Ca^{2+} ions in the yeast cell described in the first problem is 100 nM (a typical value). Calculate the number of Ca_2^+ ions in the cell.

Name: _____

2. Suppose that you and a friend are playing a game in which one of you tosses a coin three times in succession, and the result of the game is defined in terms of the number of times the coin lands heads-up.
- (a) (4 pts) Define the sample set for one round of the game, *i.e.*, all of the possible outcomes defined in terms of the sequence of heads (H) and tails (T).
- (b) (2 pts) Assuming that the coin is fair, calculate the probability of each of the outcomes in the sample set.
- (c) (4 pts) Define a set of four events, E_0 , E_1 , E_2 and E_3 , where the subscript represents the number of heads. Define each of these events in terms of the elements of the sample set, and calculate the probability of each of these events, assuming the coin is fair.